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Table of Contents

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A Preliminary Study on the Management Strategy of University Personnel Files based on Artificial Intelligence Technology

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Abstract: In order to improve the management strategy for personnel files in colleges and universities, simplify the complex process of file management, and improve file management security and content preservation of the files. This paper elaborates on the application of Artificial Intelligence (AI) technology in university personnel file management through theoretical analysis based on the understanding of AI technology.

Keywords: AI technology; Personnel files; Management strategy

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1 Introduction

Artificial intelligence (AI) was first proposed in 1956. In addition to the development of the times, AI has been applied to various aspects of life and science, also it is called "one of the three cutting-edge technologies in the 21st century." Qin Xia (2020) proposed that the Internet of Things (IoT) technology can be applied to personnel files, and the use of IoT technology can accomplish the intelligent processing of personnel files[1]. In the process of managing personnel files, the IoT technology can be used to design a functional system with modules such as label initialization, file receiving, borrowing management, file statistics, user management, system management, and my information, which can improve the management of personnel files. Similarly, Chen Huiming *et al* (2020) proposed that AI enabled file management can accomplish digitization, meet the needs of social development, and meet the needs of users[2]. It can handle a large amount of data and multiple types of file management, and accomplish the simplicity of file management, as well as convenient processing. Fang Binxing *et al* (2020) proposed that AI empowerment has the function of dissemination, which can enhance the information dissemination power of the society, enhance the ability of the public to obtain information, achieve the efficient matching of information, and provide the possibility for in-depth monitoring[3]. AI empowerment can meet the needs of file management and achieve the intelligent development of file management. At the same time, Zhang Yang (2020) proposed that Big Data can be used to accomplish the digitization of archives management, cloud storage, data retrieval, data service and information service[4]. Furthermore, Yan Guangjun (2019) proposed that the current internet technology archives management still has certain problems and limitations, the security risk factor is high, and the management strategy and management concept needs to be changed to improve the attainment of intelligent file management[5].

2 Difficulties in Managing the University Personnel's Files

2.1 Large amount of information

At this stage, most colleges and universities have

various types of file information and data materials, also the content is relatively large as its mainly including digital and image information formats. Although the content of the files includes design and settings, but most universities have organization and management systems to handle it. However, the unregulated standardization of data and information in the archives leads to the confusion, which has a greater impact on the collection and arrangement of archive data by administrators, as well as it increases the difficulty in archives management. This situation has led to a decrease in the efficiency of university management and hindered the sustainable development of university archives management, which is a great obstacle when improving the development of universities.

2.2 Lack of structure

The "atypical" phenomenon in the archives of colleges and universities is very severe. Information and data appearing in university personnel files will be summarized in archive records. If archive information cannot be classified and collected accurately, it will be very difficult for employees to search when using archives, thereby reducing the number of archives and the value of data used. The internal information of universities is mainly "unstructured" information, which must be collected and classified for the effective use of archive resource information in enhancing the process of intelligent management.

2.3 Inability to use invisible information effectively

Invisible resource information is the main part of personnel files, and the file system is generated as an "obvious information resource." Explicit resources have the characteristics of communication, exchange and expression, and are relatively easy to obtain. Retrieving invisible information from the archives is relatively difficult. Most invisible data is mainly collected based on the independent judgment and work experience of the management. It has the characteristics of independence and exclusivity, and it cannot use objective data for display and expression, as well as information sharing is very difficult.

3 AI Technology Applications in Personnel File Management

3.1 Rapid information collection

Traditionally personnel files were mainly recorded on paper, which not only took a lot of space, but is also inconvenient to store and carry. In the rapid development of artificial intelligence, the task of file management has shifted from paperless to automated. The achievement of automation effectively shortens the working time and improves the efficiency of file management in a specific way. Artificial intelligence is capable of storing and collecting information, thus it is widely used in document management, re-embedding classified paper documents and finally generating electronic documents. In the information era, using intelligent technologies is one of the effective ways to improve the efficiency of file management. For example, intelligent technology for execution and learning, as well as various types of intelligent technologies. Apply intelligent themes to your archive collection with powerful self-control, initiative and adaptability. However, there are huge differences between intelligent themes and other themes. Therefore, administrators need to apply each theme in a unified manner so that they really have the ability to process and collect files. In the era of internet, the application of artificial intelligence in file management will be further developed. The application of AI technology is mainly based on intelligent technology learning. Big Data training can lead to deep learning, and summarizing the laws and knowledge of computer applications. In file management operations, global quantification of file information is the main prerequisite for the application of AI. Administrators need to build network systems through AI, improve network system services, and ensure that network systems can explicitly fulfill users' needs.

3.2 Improve security

Protecting files is a basic task, and only protected files can lay the foundation for future work. In order to ensure the strong security management of file, the administrator can use smart technologies such as voice and fingerprint to complete this operation, so that they can easily retrieve and return data, and provide strong technical support to improve work efficiency. Currently, the AI surveillance system is constantly being optimized and improved. The upgraded system will detect video images and send alert signals to constantly remind administrators, thereby they can increase their awareness of security precautions and propose solutions when security alert occur. No accidents such as information leakage and file loss will occur, personal information can be fully protected, and AI will automatically set the optimal design and settings for file storage to ensure that external factors will not damage the files stored in the computers. Currently, the management department mainly uses firewalls and monitoring systems to complete the protection work and the detection system can monitor illegal intrusions in real-time and play a protective role. The firewall integrates a variety of technologies to analyze and block insecure access in real time, thereby promoting effective database management. In most cases, firewalls will block viruses and ensure that the file system is not damaged by external attacks. In addition, the firewall can attain real-time monitoring and search for damaged or attacked data perfectly.

3.3 Intelligent file classification

Intelligent file classification mainly refers to the intelligent processing of classifying and sorting files based on smart technologies such as machine learning and natural language processing to group and collect files to achieve the purpose of efficient and standardized substantial file classification. In the file classification phase, the system is trained and modeled through a large number of classified files, and then the model is used to analyze the content of the archive files and determine the classification number and retention period of the file. In the classification stage, the system automatically classifies the year, retention period, classification number, creation date and other fields of information according to the classification guidelines. In the grouping and packing stage, the system sets the packing guidelines (year, retention period, classification number) and saves the pages at the time of the last change of the files, and waits for the folder grouping operation to be automatically completed.

3.4 Intelligent file retrieval

Intelligent file retrieval mainly refers to improving the real-time and accuracy of archive retrieval with the help of OCR recognition, speech recognition, image recognition, machine learning and natural language processing technologies to facilitate the access and acquisition of archive resources. The biggest difference between intelligent retrieval and traditional information retrieval is that the function of intelligent retrieval includes intelligent semantic retrieval, and the retrieval results support the authorization-controlled intelligent retrieval process, as shown in Figure 1.

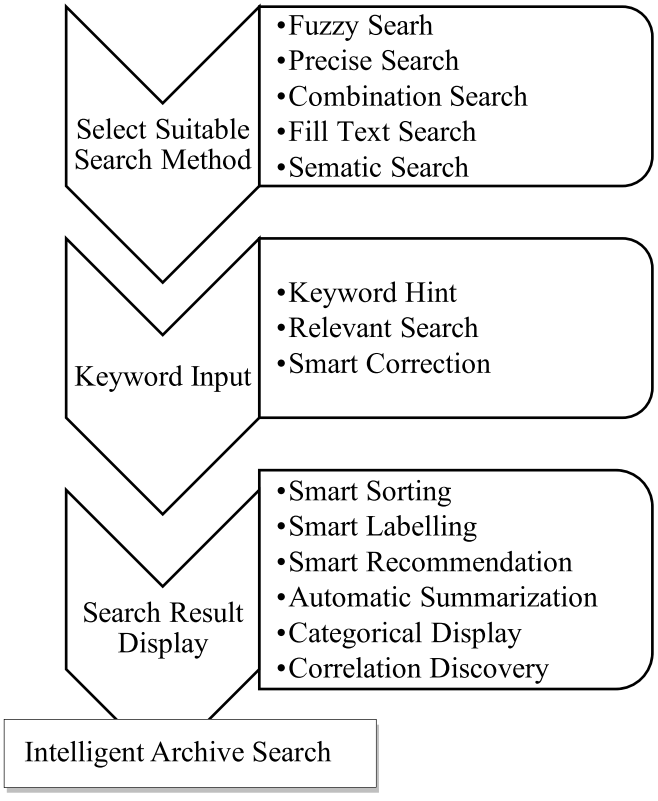

Figure 1. Search process flow

4 Conclusions

In conclusion, due to the in-depth development and application of AI, the field of archivology is inevitably involved in the trend of AI development. The archiving scene will provide a more colorful technical picture and provide new opportunities for solving the problems in the archival work. Although running AI-supported files is favored by most enterprises and universities, but in general the application of AI technology in China's personnel file management is still in the experimental and exploratory stage, and there is still a lack of cases of industry-level application. Based on this phenomenon, archive management in the information age must be solved by technological changes. The archives develop from information, accelerate the application and expansion of related data resources, improve the evolution from "single data source" to "multiple data sources," updates concepts, actively expands relevant technical capabilities, as well as strengthen and track the development of "cognitive intelligent technology." Transition to "cognitive intelligence technology," focuses on practice, actively introducing and exploring related application scenarios, attaining the upgrade from "intelligentization of specific archive links" to "intelligentization of the entire archival process." Additionally, enhance collaboration and establish related improvement collaboration system to open up the scenario from "single-theme exploration" to "multiple-theme collaboration."

Disclosure statement

The author declares no conflict of interest.

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A 28GHz Power Amplifier with Analog Predistortion Linearizer in 65nm CMOS

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Abstract: This paper proposes that a radio frequency power amplifier is suitable for a 5G millimeter wave. It adopts a three-stage single-ended structure at 28GHz. An analog predistortion linearization method is used to improve the linearity of the power amplifier (PA). As a result, there is a significant improvement in power-added efficiency (PAE) and linearity is achieved. The Ka-band PA is implemented in TSMC 65nm CMOS process. At 1.2V supply voltage, the PA proposed in this paper achieves a saturated output power of 15.9dBm and a PAE of 16%. After linearization, the output power at the 1dB compression point is increased by 2dBm, with efficient gain compensation performance.

Keywords: Millimeter wave; Power amplifier; Predistortion linearization; CMOS

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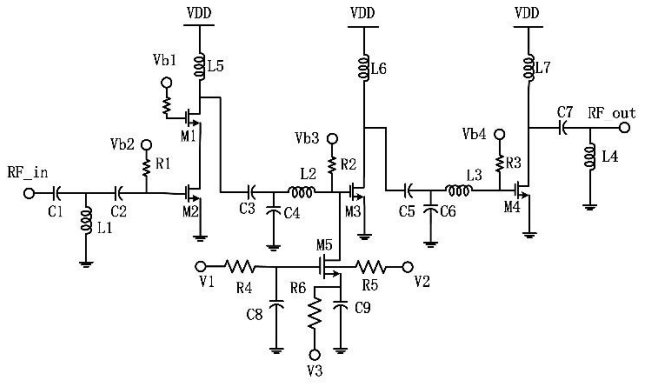
1 Introduction

In association with the rapid development of wireless communication technology, many complex modulation methods have been applied, thereby the transmission signal has a high peak-to-average power ratio (PAPR), and the PAPR signal is more likely to enter the saturation region and cause a nonlinear distortion. In order to improve the linearity, power back-off method can be used, but this reduces the working efficiency of the PA. “Doherty PA” is a method commonly used in recent years to improve efficiency when there is a power back-off [1].

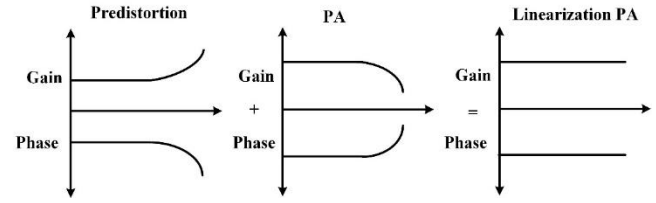
In addition with the application of 5G mobile communication technology, high bandwidth and high linearity of PA are required, thus power back-off cannot meet the requirements of high linearity. Therefore, there are many linearization techniques reported in recent state-of-the-art PAs. In exhibiting second-order intermodulation feedforward cancelling circuit, auxiliary path produces third-order intermodulation (IM3) distortion, by connecting in parallel with the main amplifier, the third-order components of the two cancels each other out[2]. However, the added auxiliary PA reduces the efficiency of the entire circuit and increase circuit cost. Predistortion linearizer is relatively simple to implement, and has a relatively wide dynamic range as well as operating bandwidth, which has gradually become the mainstream of linearization technology in millimeter wave frequency band. In a parasitic diode in the p-n junction of NMOS is used to form a linearizer, and added to the circuit, which can significantly cancel the IM3 terms[3]. In cold-mode MOS transistor has been used for MMW PA. It is a built-in linearization technology, which uses its nonlinear distortion characteristics to achieve addition compensation[4]. In order to meet the requirements of high linearity and improve the output 1dB compression point of output power, analog predistortion is a good choice. Cold-mode MOS transistor linearization method is easy to implement and can reduce chip area.

In this paper, a PA with enhanced cold-FET predistortion linearizer is implemented in 65nm CMOS process. A cold-mode MOSFET body bias circuit is placed in front of the driver stage transistor to compensate for the distortion characteristics of the PA. This linearization

technique improves the additional expansion capability of the circuit, and the linearity is also improved.



(a)



(b)

Figure 1. (a) Schematic of proposed PA with predistortion linearizer, (b) Predistortion structure schematic

2 Circuit Design

The schematic diagram of the proposed circuit is shown in Figure 1(a). This circuit adopts a three-stage single-ended structure, including a Cascode stage, and a two-level common source stage, composed of transistors M1, M2, M3, and M4. Common source structure can use lower supply voltage to achieve a higher voltage swing, the output stage adopts a common source structure to improve the output swing of the circuit, and the intermediate driver stage adopts a common source structure to drive the power stage. At high frequencies, due to the Miller effect caused by parasitic capacitance, the common source structure does not have high advanced characteristics. Therefore, the Cascode structure is added in the first stage to reduce the Miller effect, thereby increasing the benefits of the circuit, also improving the reverse isolation and stability of the overall circuit. Due to the high linearity of the Class A power amplifier, the three-stage amplifying structure all work in Class A, as well as the gate bias voltages Vb1: 0.75V, Vb2: 0.75V, Vb3: 0.8V and Vb4: 0.85V, respectively.

The matching network is achieved by inductance and capacitance. The output stage adopts an L-shaped matching network, which is simple in structure and easy to achieve, and has low loss to the output stage. The optimal load resistance of the power stage transistor is easily matched to the output load. The input stage adopts a T-shaped matching network. Conjugate matching is a very good application between stages, which can get better gain and efficiency. The series inductors (L2 and L3) are used in the inter-stage matching circuit to improve the circuit benefits.

Capacitors C1, C3, C5, and C7 are not only used as part of the matching network, but also used as DC block. C1 and C7 can prevent input and output signals from interfering with the circuit. C3 and C5 isolate the driver stage and the power stage, which can prevent the mutual influence between the stages, at the same time have the function of transmitting signals. In addition, they are responsible for the function of transmitting signals. The inductors L5, L6, and L7 are used as radio frequency (RF) choke to isolate the DC path and the RF path. It can inhibit high-frequency signals from entering the system. The value is slightly larger than that of ordinary inductors.

In order to meet the high linearity requirements of wireless communication systems, an analog predistortion linearizer circuit is used to improve the linearity of the PA. The basic principle is shown in Figure 1(b). A predistortion linearizer circuit is placed in front of the power amplifier, where it will produce a non-linear distortion, and the distortion characteristics are opposite to the PA. By using this structure, the gain and phase of the PA will be compensated, therefore the nonlinear distortion of the PA can be cancelled. The MOS transistor will produce nonlinear distortion during the cold mode operation. Therefore, the MOS transistor under this working condition can be regarded as an analog predistortion device to form an analog predistortion circuit. As shown in Figure 1(a), this analog

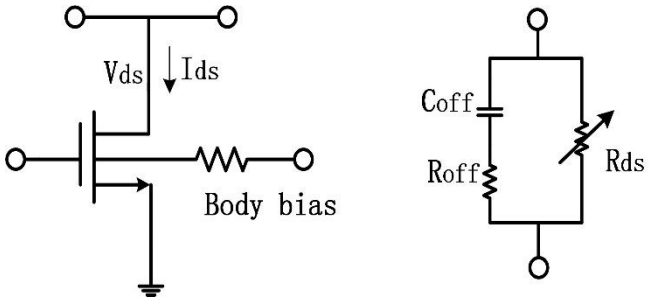
predistortion circuit is connected to the gate and source of the MOS tube by two bias resistors, as well as bypass capacitors are added to the gate and drain. Due to the parasitic capacitance of the cold-mode MOSFET, when the operating frequency increases, the added expansion capability will decrease, thus this kind of cold-mode MOS transistor predistortion circuit is often used in low-frequency circuits[5]. In order to improve the added expansion capability of the predistortion linearization circuit of the millimeter wave band PA, an enhanced cold-mode PA linearization circuit using body bias technology was proposed[6]. As shown in Figure 2, on the basis of cold-mode MOS predistortion, body bias technology is added to improve the added expansion capability of the circuit. The cold-mode predistortion linearizer can be equivalent to the capacitor C_{off} and the resistor R_{off} in series and then connected in parallel with the current source. The current source can be regarded as a variable resistor. Its DC-IV curve is shown in Figure 3. When the input power increases, the greater the dynamic range of R_{ds} changes, the stronger the added expansion capability is displayed. R_{ds} changes with the changes of V_{ds} and Ids, and the relationship between them can be expressed as,

$$|R_{ds}| = |\partial V_{ds}/\partial I_{ds}| \quad (1)$$

Where V_{ds} and I_{ds} are the drain-source voltage and current of the MOS transistor, respectively. It can be seen that R_{ds} is inversely proportional to the slope of the DC-IV curve. The smaller the R_{ds}, the larger the slope of the curve. The larger the linear range of the curve, the wider the range from linear to saturation, and the more obvious the predistortion characteristics. The stronger the added expansion capability.

As the R_{ds} decreases, the slope of the curve gradually increases, and the linear region of the curve becomes larger. The range from the linear region to the saturation region will be wider, the distortion characteristic will be more obvious, and the added expansion capability will be stronger. After adding the body bias resistor, it will increase the slope of the curve and increase the range of non-linear changes, thus having stronger distortion characteristics.

Figure 2. Equivalent circuit of proposed predistortion circuit



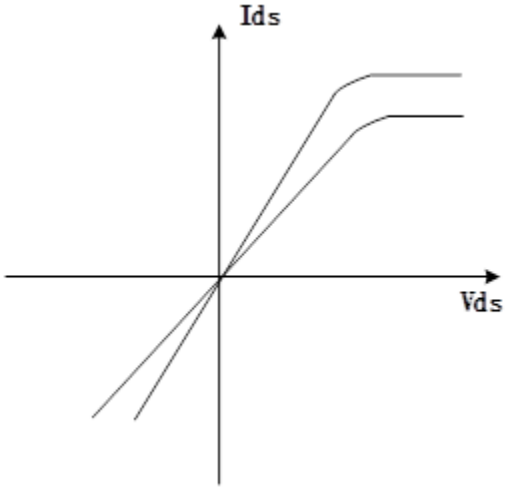


Figure 3. DC-IV curve

3 Simulation Result

The PA designed in this paper uses 1.2V power supply voltage and is realized by 65nm CMOS process. The simulated S-parameters of this PA with enhanced linearizer on and off are shown in Figure 4 and Figure 5. The input return loss S_{11} is affected slightly with linearizer on and off because of the input impedance of the linearizer, thus S_{11} reflection coefficient is small. However, the output return loss S_{22} has a certain offset. As shown in Figure 5, it can be seen that the small signal added has a large change. When the linearization is turned on, S_{21} is 25dB. When the linearization is turned off, S_{21} is reduced by 2dB due to the added expansion characteristics at 28GHz. The reverse isolation has not changed much and the overall isolation is better, as its less than -50dB.

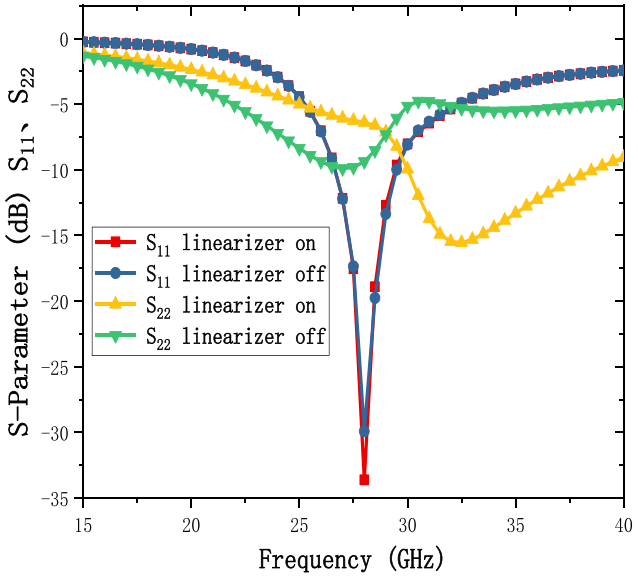


Figure 4. Simulated S_{11}, S_{22} of PA with linearizer on and linearizer off

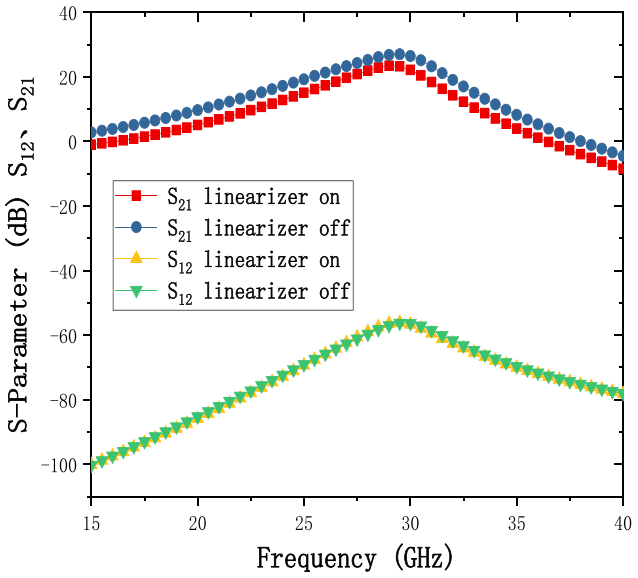


Figure 5. Simulated S_{12}, S_{21} of PA with linearizer on and linearizer off

Figure 6 shows the simulated large signal performance of this PA at 28GHz. When the enhanced linearizer is turned off, the saturation power is 15.3 dBm, with output power at the 1dB compression point (OP_{1dB}) of 11.9dBm. With the opening of linearization technology, the saturated output power is increased to 16dBm, and the output power at the 1dB compression point is 14 dBm. The result shows that the linearity has been improved, and P_{1dB} of PA has increased by 2dBm with linearizer on.

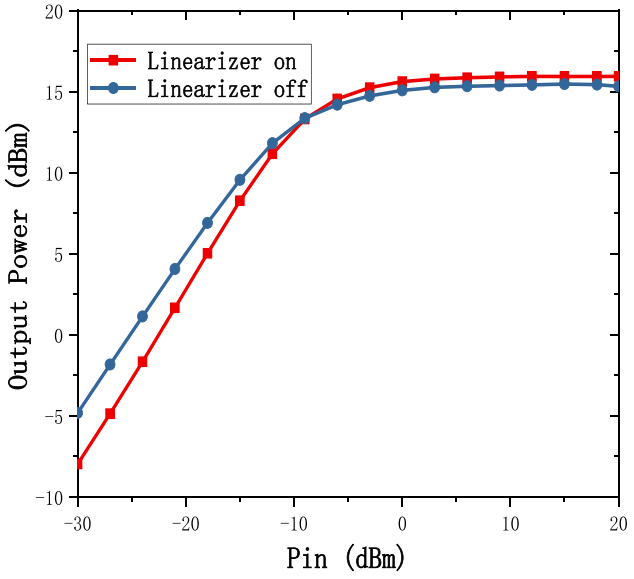


Figure 6. Simulated Pout of PA with linearizer on and linearizer off

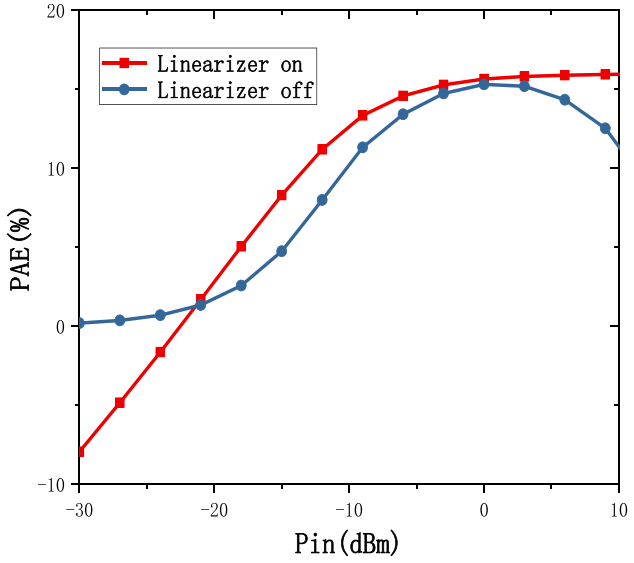


Figure 7. Simulated PAE of PA with linearizer on and linearizer off

Figure 7 shows the curve of efficiency versus input power. Before linearization is turned on, PAE has 15% peak PAE, and the efficiency at the input 1dB compression point is 9.2%. After linearization is turned on, PAE has a peak PAE of 16%, and the efficiency at the input 1dB compression point is 12.6%. Therefore, through analog predistortion linearization technology, the efficiency at the input 1dB compression point has been greatly improved. Table 1. shows a summary of the performance of the proposed PA and a comparison with a recently reported mixer operating in the Ka-band. We can

see that the proposed analog predistortion linearization method can improve the linearity of the PA while maintaining better gain characteristics.

Table 1. Performance Summary and Comparison with State-Of-The-Art PA

Ref	Process	Vdd (V)	Freq (GHZ)	Gain (dB)	P1dB (dBm)	Psat (dBm)	PAE_{max} (%)
1	65nm CMOS	2.5	28	21.1	19.84	21.4	15
2	90nm CMOS	-	60	13.1	18.9	18.9	-
3	180nmCMOS	1	23	12.8	15.8	18	15
4	28nm CMOS	1	30	15.7	13.2	14	35.5
5	65nm CMOS	1.1	28	15.8	14	15.6	41
This Work	65nm CMOS	1.2	28	25	14	16	16

4 Conclusion

This paper proposed a predistortion linearizer for millimeter wave CMOS PAs. The PA with the proposed linearizer implemented by 65nm CMOS process can provide PSAT of 15.9dBm and P1dB of 13.9dBm with a high gain of more than 20dB. It also has a peak PAE value of 16%. The proposed linearization technology has good added expansion capability which improves the output power and efficiency of the power amplifier to a certain extent

Disclosure statement

The author declares no conflict of interest.

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Morphology, Dynamical Mechanical and Flame Retardant Properties of Nylon 1212/Organic Montmorillonite Nanocomposites Prepared by Melt Compounding

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Abstract: Nylon 1212/organic montmorillonite (OMMT) nanocomposites were prepared using the melt compounding method. The morphology and dynamical mechanical properties of the nanocomposites were investigated using transmission electron microscope (TEM) and dynamic mechanical analysis (DMA). The storage modulus of nylon 1212/OMMT nanocomposites was increased with increasing OMMT. The flame retardant properties were characterized by cone calorimetry, scanning electron microscope (SEM) and X-ray photoelectron spectroscopy (XPS). The flame retardant properties were characterized using cone calorimetry, whereby nylon 1212/OMMT nanocomposites were improved compared with pure nylon 1212 because of the carbonaceous-silicate granular materials which were formed during combustion, thus proposing the flame retardant mechanism.

Keywords: Mechanical properties; Nanocomposites; Nylon; Polymer processing

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1 Introduction

In the past decade polymer/montmorillonite nanocomposites have attracted great interest from academic and industrial researchers due to the nanosized montmorillonite (MMT) being able to greatly improve the thermal and mechanical properties[1-7]. The introduction of nanosized clay can accelerate the crystallization rate of crystallizable polymers, with the clay layers acting as nucleating agents[8]. Wu *et al.* (2002) showed Nylon 1212 exhibited heterogeneous nucleation in the presence of MMT and an increased crystallization rate[9]. However, pure Nylon 1212 crystallized as spherulites, where the spherulites of the nanocomposite were finely formed small or homogeneous size because it nucleated as it grew on the surface of the silicate layers. Since the mobility of the macromolecule chains are restricted by adding nanosized fillers, thus the glass transition temperature (T_g) of the polymer will change. Dynamic mechanical analysis is an important method to characterize the glass transition. Yu *et al.* (2004) employed dynamic mechanical analysis to study the T_g of nylon 66/MMT nanocomposites[10]. The results showed that T_g of the nylon 66/MMT nanocomposites shifted to a higher temperature with increasing of the nanosized MMT contents compared to pure nylon 66[10]. Some researchers have reported that some polymers showed two T_g when tested using dynamic mechanical analysis (DMA) due to the mobility of the macromolecule chain segments being restricted by the nanosized fillers[11-13]. The movement of some of the macromolecule chain segments will begin at the normal T_g temperature, while the restricted parts will begin moving at a higher temperature.

The flame retardant properties of the polymers can be improved by adding MMT. Wang *et al.* (2002) confirmed that the barrier properties of the MMT provided a mechanism by which nanocomposite formation can enhance the fire retardance of the polymers[14]. Wang *et al.* (2004) studied that when comparing the flame retardance of ABS/MMT nanocomposites with MMT nanocomposites showed lower heat release rate (HRR) peak and higher limiting oxygen index (LOI) than that of conventional flame retardant ABS[15]. Kashiwagi *et al.* (2004) reported that the PA6/clay nanocomposite samples (clay contents of 2 and 5% by mass with 8mm thickness) significantly reduced the HRR peak of the PA6 sample[16].

Nylon 1212 is one of the most important semicrystalline engineering plastics in the family of nylons. It has superior physical and chemical properties compared to polyolefin plastics[17]. So far, there are limited reports about Nylon 1212/MMT nanocomposites in our research[18-19]. In the present study we prepared nylon 1212/organic montmorillonite (OMMT) nanocomposites using melt compounding method. Transmission electron microscopy (TEM) was employed to characterize the morphology of the nylon 1212/OMMT nanocomposites. The effect of OMMT on T_g of nylon 1212 was characterized by DMA. The thermo-stabilities of nylon 1212 and nylon 1212/OMMT samples were determined using thermogravimetric analysis (TGA). The flame retardant properties of the nylon 1212 and nylon 1212/OMMT nanocomposites were characterized using cone calorimetry, scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS).

2 Materials

2.1 Experimental materials utilized

Nylon 1212, with a melting index of 14g/10min (230°C, 2.16kg) was supplied by ShanDong DongChen Engineering Plastic Co., Ltd., China. The clay used in this paper was a natural OMMT modified by cetyl dimethyl benzyl ammonium chloride (CDBAC) with a cation exchange capacity of 120meq/100g, and trade name of DK3 which was obtained from Zhejiang Feng Hong Clay Co., Ltd., China. All the materials were dried in a vacuum oven at 80°C for 12h before the melt blending.

2.2 Preparation of nylon 1212/OMMT nanocomposites

The nylon 1212 was blended with 0, 3, 5 and 7wt% OMMT via a melt compounding method using a twin-screw extruder (L/D = 40, D = 20mm, Nanjing KY Chemical Machinery Co., Ltd., China) with a screw speed of 200Hz/min at 190°C, and then the extrudates were pelletized with a pelletizer. Parts of the extrudates were processed into 125mm×13.0mm×3.0mm bars by an injection molding machine (CJ-80, Chen De Plastics Machinery Co., Ltd., China). Other parts of the extrudates were compression molded into 100mm×100mm×4mm thick square plaques at 195°C and 150bar with the plaques cooled together with the molds in room temperature.

3 Methods

3.1 Transmission electron microscopy (TEM) measurements

The morphology of the nylon 1212/OMMT nanocomposites was observed by a JEOL 200CX (JEOL Ltd., Japan) TEM at an accelerating voltage of 120kV. Ultra-thin sections were cut from the injection molded bars perpendicular to the flow direction under cryogenic conditions using an LKB-5 (LKB Co, Switzerland) microtome.

3.2 Dynamic mechanical analysis (DMA) measurements

The dynamic mechanical analysis (DMA) was performed on a TA Q800 DMA (TA Instruments, USA). The measurements were carried out at 1Hz under a heating rate of 5°C/min. The temperature range was from -50°C to 170°C. The low temperature measurements were performed in a stream of dry air cooled with liquid N_2, and the high temperature tests were carried out under N_2 protection.

3.3 Flame retardant property measurement

Cone calorimeter measurements were carried out

with a FTT Standard Cone Calorimeter (Fire Testing Technology Ltd., U.K.) at an incident heat flux of 50KW/m^2 in accordance with the ISO5660 standard. The specimens were (100mm× 100mm× 4mm) square plaques. The data reported here is the average of three replicated experiments. The samples which were used in the cone calorimeter analysis were then used to characterize the morphology and elements of the char layers.

3.4 Scanning electron microscopy (SEM) and x-ray photoelectron spectroscopy measurement

The surfaces of the combustion samples of nylon 1212 and nylon 1212/OMMT nanocomposites that had been characterized in cone calorimetry were executed in a JEOL JSM 6500F scanning electron microscope (SEM) (JEOL Ltd., Japan). At the same time, the elements of the combustion samples were characterized by X-ray photoelectron spectroscopy (XPS).

4 Result and Discussion

The TEM micrographs of the nylon 1212/OMMT nanocomposites are shown in Figure 1, lighter areas are the nylon 1212 matrix and the dark lines are the silicate layers. Figure 1 clearly showed both exfoliated platelets and some intercalated structures. It can be seen that most of the exfoliated OMMT layers with thickness of 5-10nm were homogeneously dispersed in the nylon 1212 matrix, a few OMMT particles were intercalated by macromolecular chains of nylon 1212 and a partly exfoliated structure was formed in the nanocomposites. The OMMT aggregated together with the increasing of OMMT contents. Most of the layers are oriented normal to the sections, as well as parallel to the slow direction.

Figure 2 shows are the storage modulus (a) and dynamic loss (tanδ) (b) as a function of temperature for the nylon 1212/OMMT nanocomposites. The storage modulus of nylon 1212/OMMT nanocomposites increased with the content of OMMT increasing below 25$^{\circ C}$. The increase of the storage modulus was about 40% when the OMMT content was 7%. However, the storage modulus of the nylon 1212/OMMT nanocomposites were not very different above 25$^{\circ C}$. The increase of the nanocomposites modulus was caused by the stiffness of the OMMT layers and the constraining effect on parts of the nylon 1212 molecular chain segments. As with other polymers, adding a small amount of OMMT can improve the stiffness of the polymer[10, 20, 21].

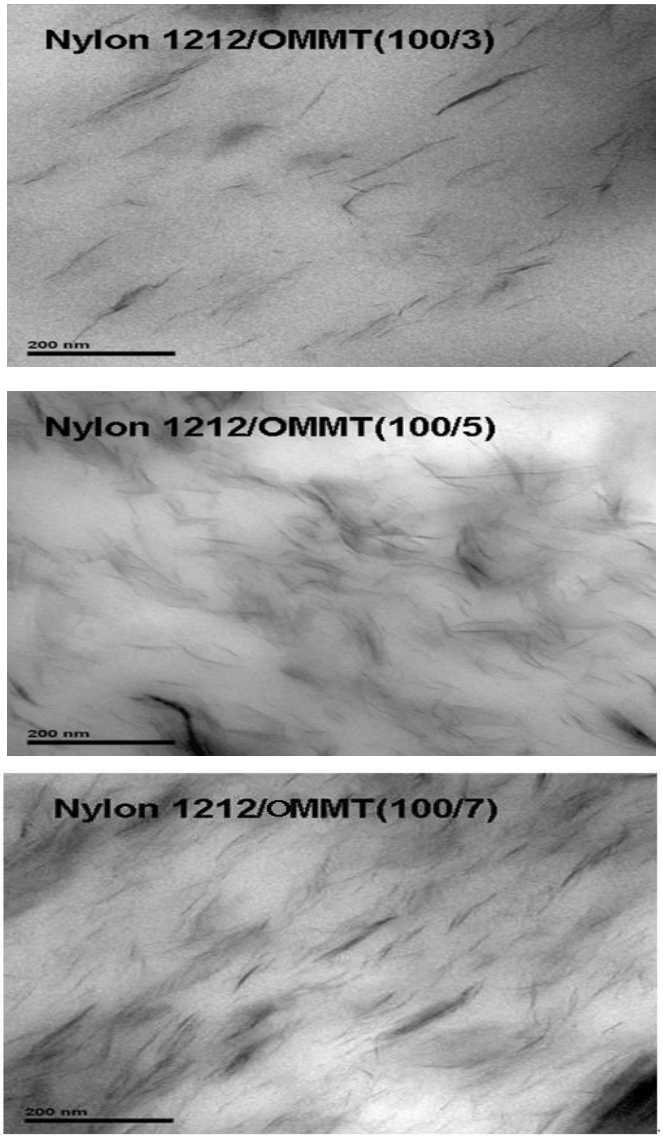


Figure 1. TEM micrographs of nylon 1212/OMMT nanocomposites containing different OMMT contents: 100/3, 100/5, 100/7

Tg of nylon 1212 can be characterized by tanδ, Figure 2 (b) shows the tanδ versus temperature curves for the nylon1212 and the nylon 1212/OMMT nanocomposites. For pure nylon 1212, there was only one peak, assigned to Tg of nylon 1212, at 65$^{\circ C}$. Generally, reinforcement by

exfoliated MMT layers will result in the glass transition temperature (T_g) of the polymer being increased slightly[10]. However, Figure. 2 (b) shows T_g of nylon 1212/OMMT nanocomposites shifted to a lower temperature by about 10°C with increasing contents of OMMT in comparison with the corresponding peak for pure nylon 1212. This is attributed to the CDBAC, some CDBAC which was not intercalated into the galleries of MMT were being adsorbed outside of the galleries, and acting as a plasticizer during compounding of the OMMT with the nylon 1212 melt. In addition, the height of the tanδ peak of nylon 1212/OMMT (100/7) nanocomposite decreased by about 17% in comparison with the corresponding peak for pure nylon 1212. This indicates that a number of chain segments of nylon 1212 in the composite samples did not participate in the plasticized glass transition, because nanosized OMMT has a high specific surface area. It is reported that the constrained volume in nylon 6 nanocomposites with 5wt% organic MMT was over 30%[22]. Therefore, the mobility of some chain segments of nylon 1212 were restricted by the nanosized OMMT. A new peak was shown in Figure 2 (b) at 115°C, as well as the fact that the phenomenon it represents was characterized by a high activation energy, indicating it was the increase in the number of restricted mobility nylon 1212 segments, which suggests that it was associated with the glass transition of some nylon 1212 chain that were restricted in mobility because of their interaction with the MMT layers.

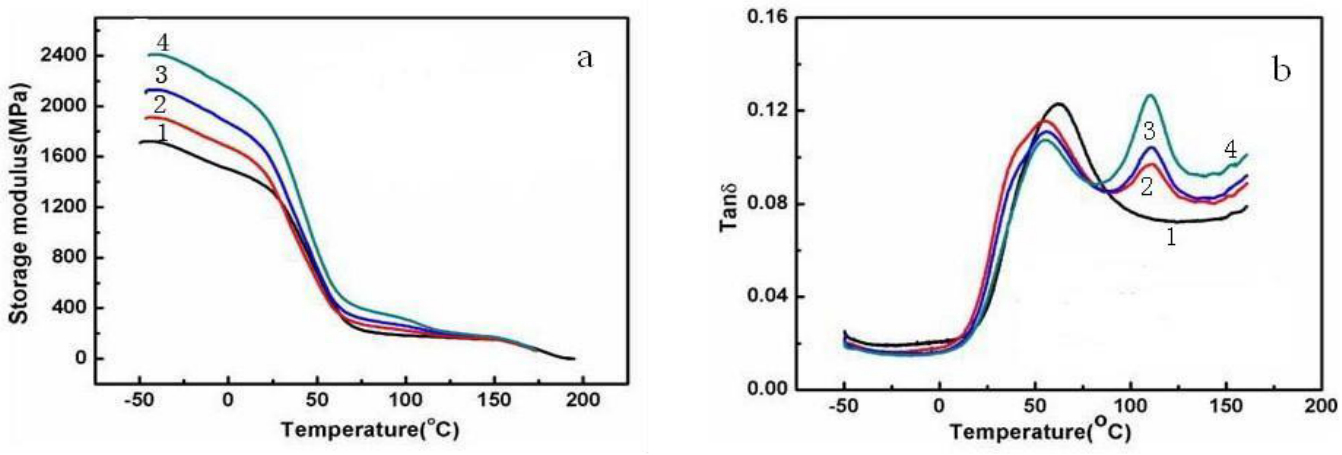


Figure 2. Plots of storage modulus (E') (a) and dynamic loss (tanδ) (b) as a function of temperature for nylon 1212/OMMT nanocomposites
1-PA1212/OMMT(100/0); 2-PA1212/OMMT (100/3); 3-PA1212/OMMT(100/5); 4-PA1212 / OMMT(100/7)

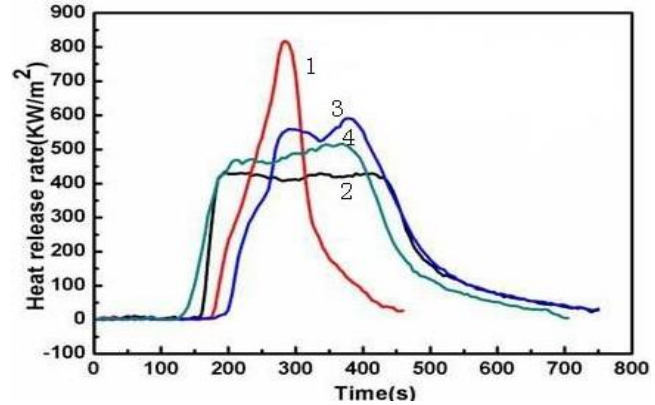


Figure 3. The HRR patterns of nylon 1212/OMMT nanocomposites
1-PA1212/OMMT(100/0); 2-PA1212/OMMT (100/3); 3-PA1212/OMMT(100/5); 4-PA1212 / OMMT(100/7)

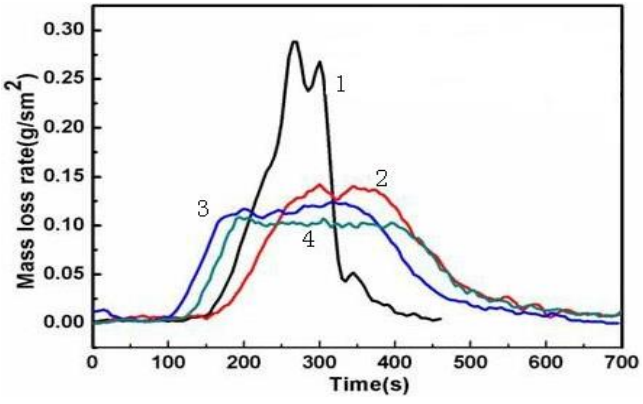
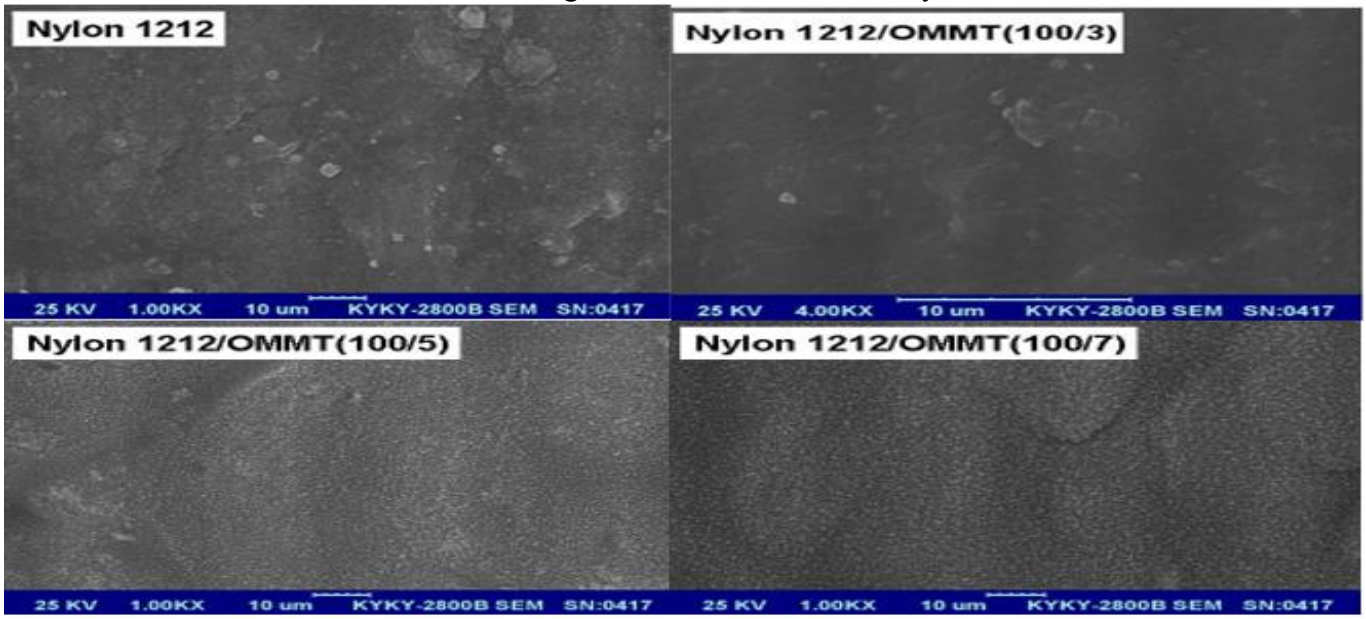


Figure 4. Mass loss rate (MLR) curves of nylon 1212/OMMT nanocomposites
1-PA1212/OMMT(100/0); 2-PA1212/OMMT(100/3); 3-PA1212/OMMT(100/5); 4-PA1212/OMMT(100/7)

The heat release rate (HRR) and the mass loss rate (MLR) were measured by the cone calorimetry tests. HRR is used to evaluate the heat released during combustion of samples and MLR corresponds to the mass loss of samples in combustion. In particular, the peak of heat release rate (PHRR) is the most important parameter to evaluate fire safety. The HRR curves of pure nylon 1212 and nylon 1212/OMMT nanocomposites with different OMMT contents are shown in Figure 3. The results showed that the pure nylon 1212 burned very fast after ignition and had a sharp peak (818kW/m^2) on the HRR curve. However, loading of OMMT into the nylon 1212 resulted in a great decline of HRR, the PHRR of nylon 1212/OMMT (100/7) was reduced by 45% compared with that of pure nylon 1212. Figure 3 also shows the HRR peak of nylon 1212/OMMT samples were broader than nylon 1212. Thus, OMTT had an effect on the combustion of nylon 1212.



.**Figure 5.** SEM images of char layer of nylon 1212 and nylon 1212/OMMT nanocomposites after combustion

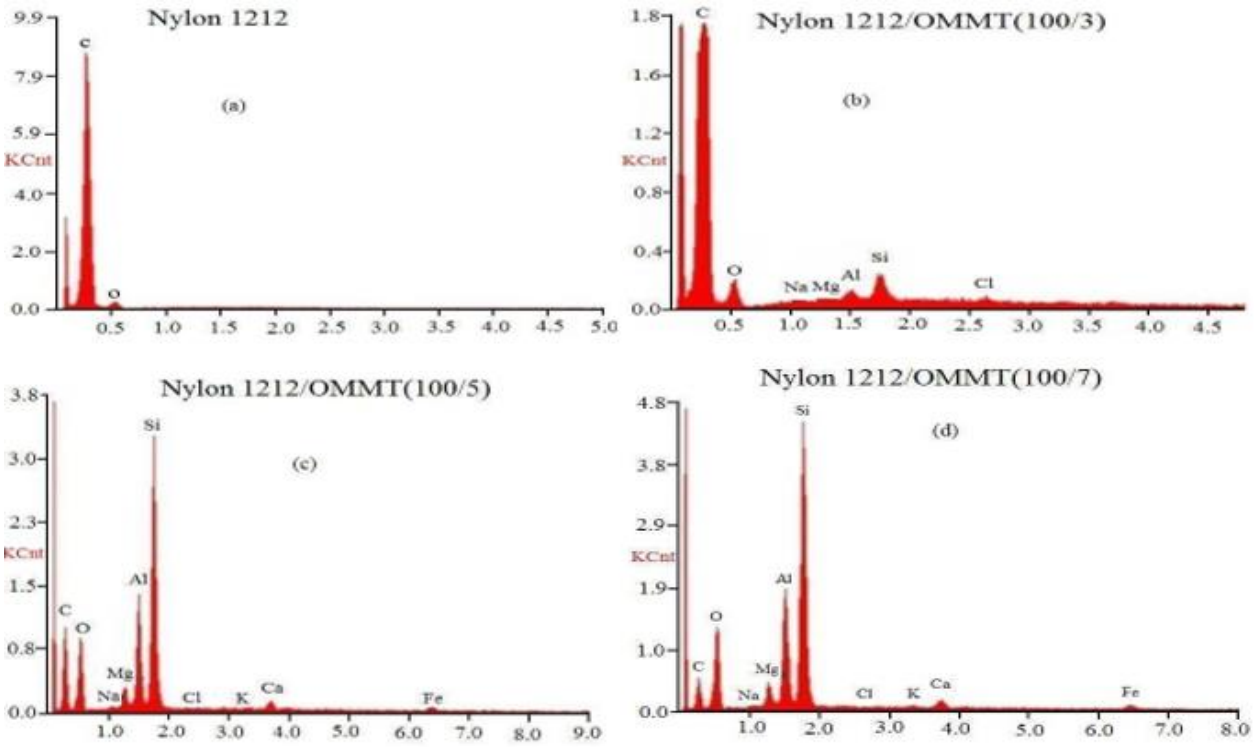


Figure 6. XPS of char layer of nylon 1212 and nylon 1212/OMMT nanocomposites after combustion

Another primary parameter which is relevant to HRR is the mass loss rate (MLR) during combustion. The plots of MLR of nylon 1212 and the nylon 1212/OMMT nanocomposites are shown in Figure 4, the trend of the evolution of the MLR was the same as that of the HRR. The pure nylon 1212 reached a sharp peak on the MLR curve after ignition in a fast manner, whereas the loading of OMMT into nylon 1212 resulted in a sharp decline, but on extension of time of MLR. Thus, the decrease of HRR and MLR of nylon 1212/OMMT indicated that the amounts of heat, smoke and poisonous gas were released slower during combustion. The improvement in flame retardant properties of polymer/OMMT nanocomposites has been reported to be due to the formation of a multilayered carbonaceous-silicate structure in the condensed phase, as shown below[23-24]. The micromorphology compositions of the char layer of nylon 1212 and nylon 1212/OMMT nanocomposites were studied by SEM, as per the results shown in Figure 5. The SEM images showed that there was a change in the surface appearance with increasing OMMT contents. It was concluded that the granular materials were carbonaceous-silicate materials after the XPS analysis. The element compositions of the char layer of nylon 1212 and nylon 1212/OMMT nanocomposites were studied by XPS, the results are shown in Figure 6. The contents of silicon (Si) were obtained by integral calculation of the peak area of the Si element, as Si increased in the char layers faster than the content of OMMT in nylon 1212 was increased, which is shown in Figure 7. Therefore, the OMMT removed to the surface of carbon contents during combustion, which will in favor a protective layer formation. This stable physical protective barrier on the surface of polymer materials is suggest to insulate the underlying polymeric substrate from the heat source, slow down heat and mass transfer between the gaseous and condensed phases[24]. The presence of OMMT created a barrier effect of the char residues formed on the surface of nylon 1212 matrix.

Therefore, these results confirm that the barrier properties of the OMMT provide a mechanism in which nanocomposites formation can enhance the flame retardancy of polymers and reduce the amount of flammable small decomposition products released during combustion.

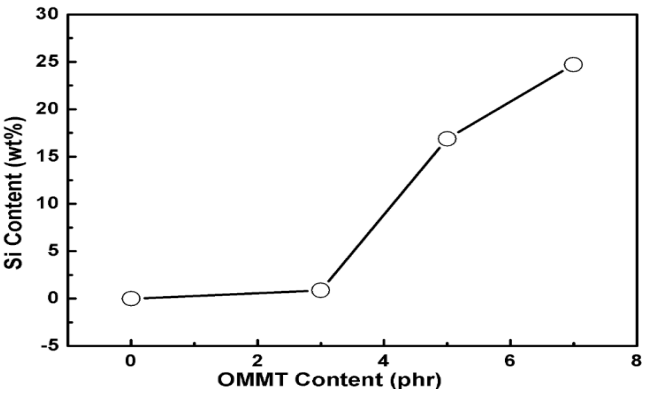


Figure 7. Si contents of the evolution with the OMMT increase of char layer of f nylon 1212 and nylon 1212/OMMT nanocomposites after combustion.

5 Conclusions

In this study, the morphology, dynamic mechanical properties and flame retardancy of nylon 1212/OMMT nanocomposites were investigated. The exfoliated OMMT layers, with thickness of 5-100nm were homogeneously dispersed in the nylon 1212 matrix. The storage modulus of nylon 1212/OMMT nanocomposites increased with the increase of OMMT contents. T_g of the nylon 1212/OMMT nanocomposites shifted towards a lower temperature by about $10^{\circ C}$ for all of OMMT contents, in comparison with the corresponding peak for pure nylon 1212. A new peak at higher temperature was observed from plots of tanδ as a function of temperature because the mobility of a number of chain segments of nylon 1212 were restricted by the nanosized OMMT. The flame retardant properties of the 1212/OMMT nanocomposites were improved with increasing OMMT contents.

Disclosure statement

The author declares no conflict of interest.

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Realization of Distribution Network Feeder Terminal Unit based on Dual-DSP

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Abstract: This paper presents the design proposal of distribution network monitoring unit based on dual-DSP. A detailed description of the hardware structure about the device is introduced which including signal scheduling, SPI communication, the serial human-computer communication and network communication. Additionally, the paper describes the software process about the master and slave DSPs. Then the analog precision test and the protection response test are carried out. The result shows that the design proposal is correct.

Keywords: Dual-DSP; Distribution Network; Monitoring unit; Signal Scheduling

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1 Introduction

Based on the increasing demand for electricity of our country, gradually ageing distribution system will not meet the power supply reliability and quality to the national industrial economic and the people's daily life. Once the faults occurred, rapid fault diagnosis and shorten outage time is significant, which could improve supply reliability and safety and decrease economic losses.

As core equipment, FTU (feeder terminal unit) plays a particularly important role in distribution automation system, which is also the focus of this study. In view of the FTU device characteristics which includes quick sampling speed, large amount data calculation, high real-time requirements, and frequent communication with the distribution master station, this article presented an intelligent design proposal of FTU based on dual-DSP.

The remainder of this paper is organized as follows. Section 2 describes system project design. Section 3 analyses some key parts of the system. Section 4 shows field test results. Finally, some concluding remarks along with open research issues are proposed in section 5.

2 System Design

We use DSP and microcontroller structure[1] in the previous design of FTU. The single chip collects the AC signal and sends it to DSP. There is insufficient time to response. Thus, we use dual-DSP structure and FTU's overall structure is shown in Figure 1.

Software functions are divided into re-closing action, SPI data communications, serial communication and network communication. Reclosing action is that the FTU as an intelligent switch deals opening or closing process under the appropriate condition. SPI data communication is to send the information obtained from the slave DSP to master DSP. Serial communication is that the FTU as on-site machine finishes its data display with its own LCD screen, as well as functional data setting. Network Communication considers FTU as a node of the network. And the switch signals and other data signals are recorded on the distribution network. Then the network can control the FTU node remotely.

It is the master DSP software flow: when FTU starts, it follows the unilateral coincidence rules. Then getting data obtained from the slave DSP,

uploading to web and screen, processing fault diagnosis according to the protection logic, and waiting for the network and the serial port instructions.

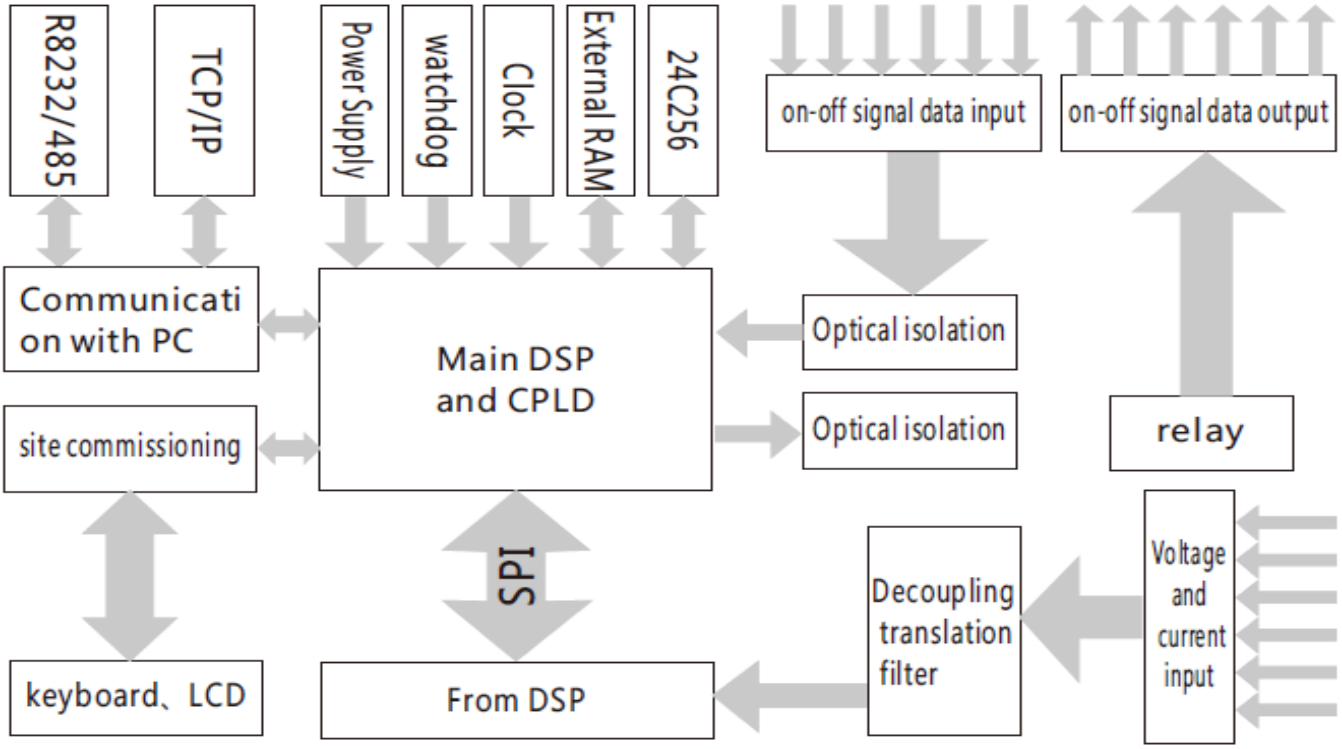

Figure 1. FTU's overall structure

3 Some Key Parts of the System

3.1 FTU hardware structure

Hardware part is mainly composed of chassis, bottom board, screen and keyboard, master CPU plug-in unit, AC sampling plug-in unit, remote signal plug-in unit, remote control plug-in unit, power plug-in unit, as well as part of the composition.

Utilizing the slot structure[2], the bottom board has a power bus, an address bus and a data bus and connects the plug-in units. Each plug-in unit has relatively independent function. There are 14 slots on the bottom board. The first is power plug-in slot, the second is master CPU plug-in slot, and the remaining 12 slots can be configured as AC sampling plug-in slot or remote control plug-in slot, the system has a strong scalability. Figure 2 FTU's hardware structure and the main plug-in units are introduced as below.

3.2 Signal Scheduling

The system uses CPLD chip XC9536 in Xilinx Corporation to process the data transmission between CPU plug-in unit and AC sampling plug-in unit, remote signal plug-in unit, remote control plug-in unit. XC9536 primarily consists of the following three modules: function module, the I/O interface module and the interconnect matrix module[3]. Among them, the function module realizes the CPLD logical processing, the I/O module provides CPLD the input and the output cushion, the interconnection matrix realizes the CPLD interior signal momentary connection [4]. Figure 3 shows the connection diagram of system signal scheduling.

The CPU signal scheduling procedure is as follows: When the CPU needs the data of the AC sampling plug-in unit, it will first notify the CPLD to select this plug-in latch, so the plug-in can connect its data bus to the CPU data bus, and the other plug-ins cannot be connected. After the operation, CPLD control the plug-in latch to isolate its data bus from the CPU data bus. Thus, the CPU can control any plug-in unit without affecting the other plug-in units, and it can finish signal scheduling perfectly.

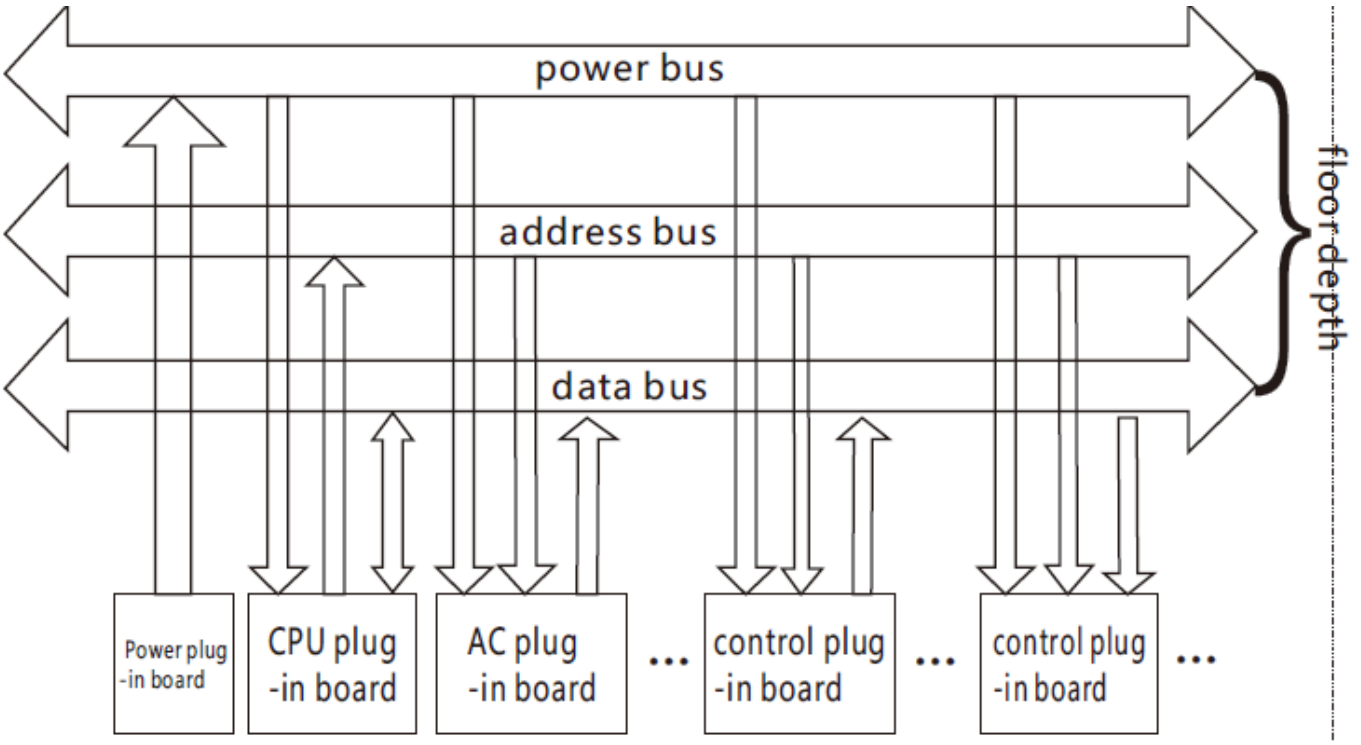

Figure 2. FTU's hardware structure and the main plug-in units

3.3 SPI Communication

The Serial Peripheral Interface (SPI), has introduced a high-speed, full-duplex synchronous serial communication bus[5]. It works in master/slave mode, supporting a master device to communicate with one or more salve devices. Its pins on the chip take up only four lines, namely: SDI, SDO, SCK and CS. SCK is a system serial communication clock signal which is controlled by the master device. SDI and SDO are data input and output pins, which is based on the square wave signal of SCK to complete the data transmission. CS is the enable pin of the slave device which is controlled by CPLD [6].

Figure 4 is the SPI communication hardware connection diagram of master -slave DSPs. The CS strobe of salve DSP is controlled by the CPLD. When the CS signal of the slave device is low, the chip can receive data on the SPI or send data to the SPI bus. SPI is a full-duplex communication, allowing data input and output at the same time.

SPI program flow is as follows: slave DSP opens a data buffer in the program to store the computed data after Analog-to-digital converter (ADC) module sampling. AC sampling plug-in unit uses the slave DSP to sample the voltage and current data, and then convert these data into effective value. When the master DSP needs data, it enables the slave DSP to translate with it. After receiving data, the master DSP firstly determines whether the received data is valid data or not by the header, then determines whether it is a valid command header or data header. After calibration, the master DSP continue the remained steps according to the SPI program flow shown in Figure 5.

3.4 Local machine communication

This system uses the LCD screen based on the RS-232 interface and DSP to finish the local machine communication. Users can easily see the feeder lines running stats, analog measurement and switch situation on spot. And users can operate the switch via key buttons. It uses the SCI module of S3C2440A chip[7] whose GPIOH interfaces can be used as serial communication port. It use the MAX232 to complete the system level conversion betweenRS232 and TTL. Figure 6 is showing the connection diagram between S3C2440A and MAX232. As well as LCD software menu structure

is shown in Figure 7.

Real-time data menu contains real-time analog circuit data and switch data, and the digital input and relay output display screen are shown in Figure 8. Value setting menu contains setting and viewing the relay logic parameters, authorized users can easily adjust some FTU relay logic through the menu, and these parameters can be uploaded to distribution main station. Additionally, this interface provides an event logging on the system. Users can find what time and what type of relay protection action that the FTU had started over through this menu, helping maintenance person to find the cause of the failure, providing the basis for excluding line fault. Figure 9 is showing the picture of the FTU value setting and event logging interface.

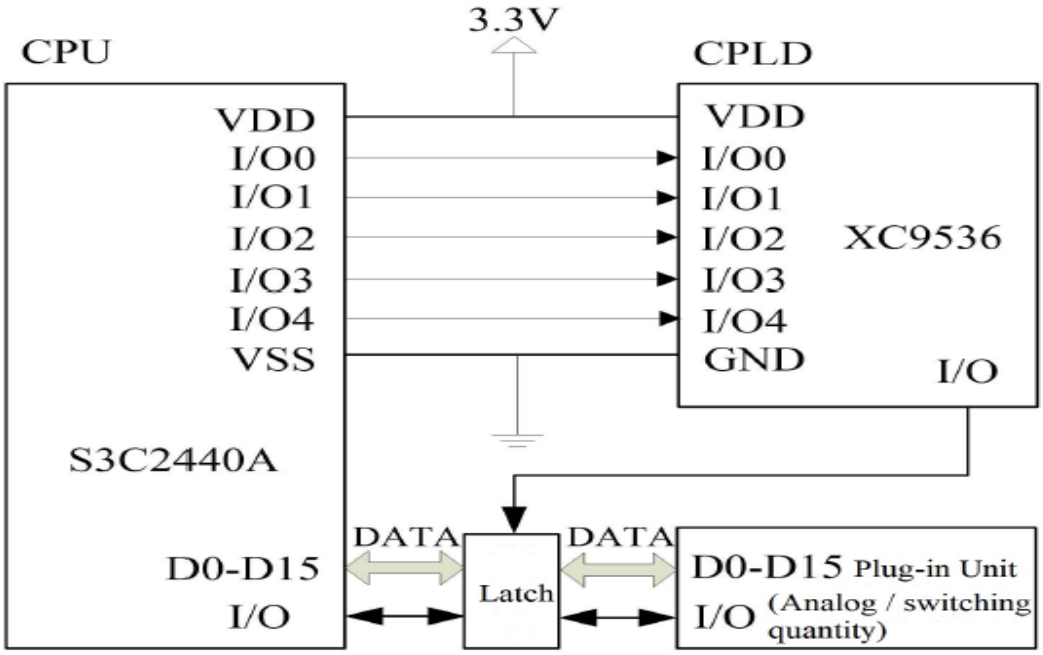

Figure 3. Signal scheduling connection diagram

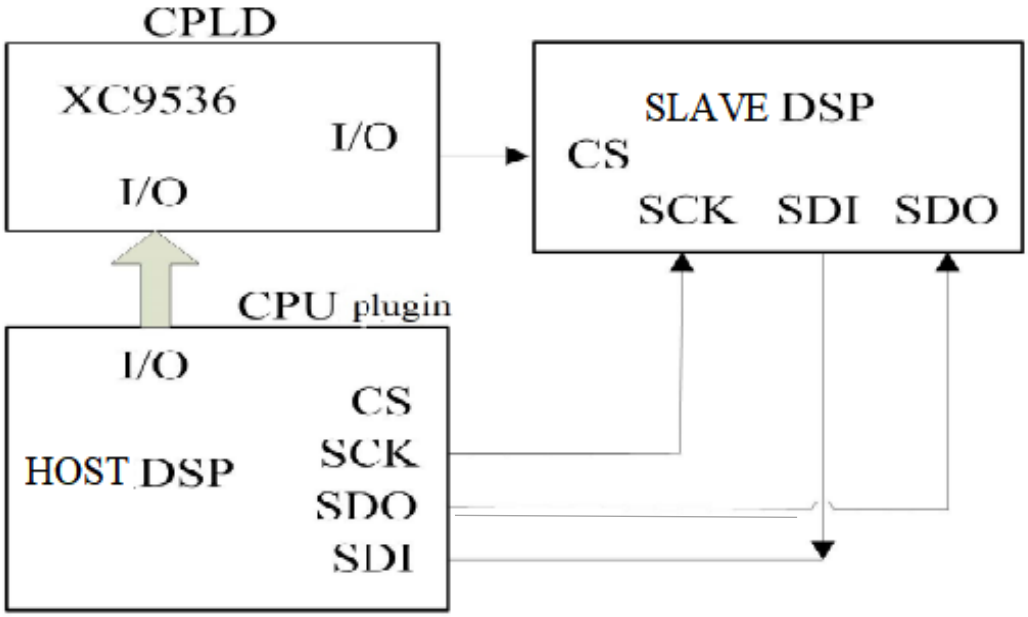

Figure 4. SPI connection of Master-slave DSPs

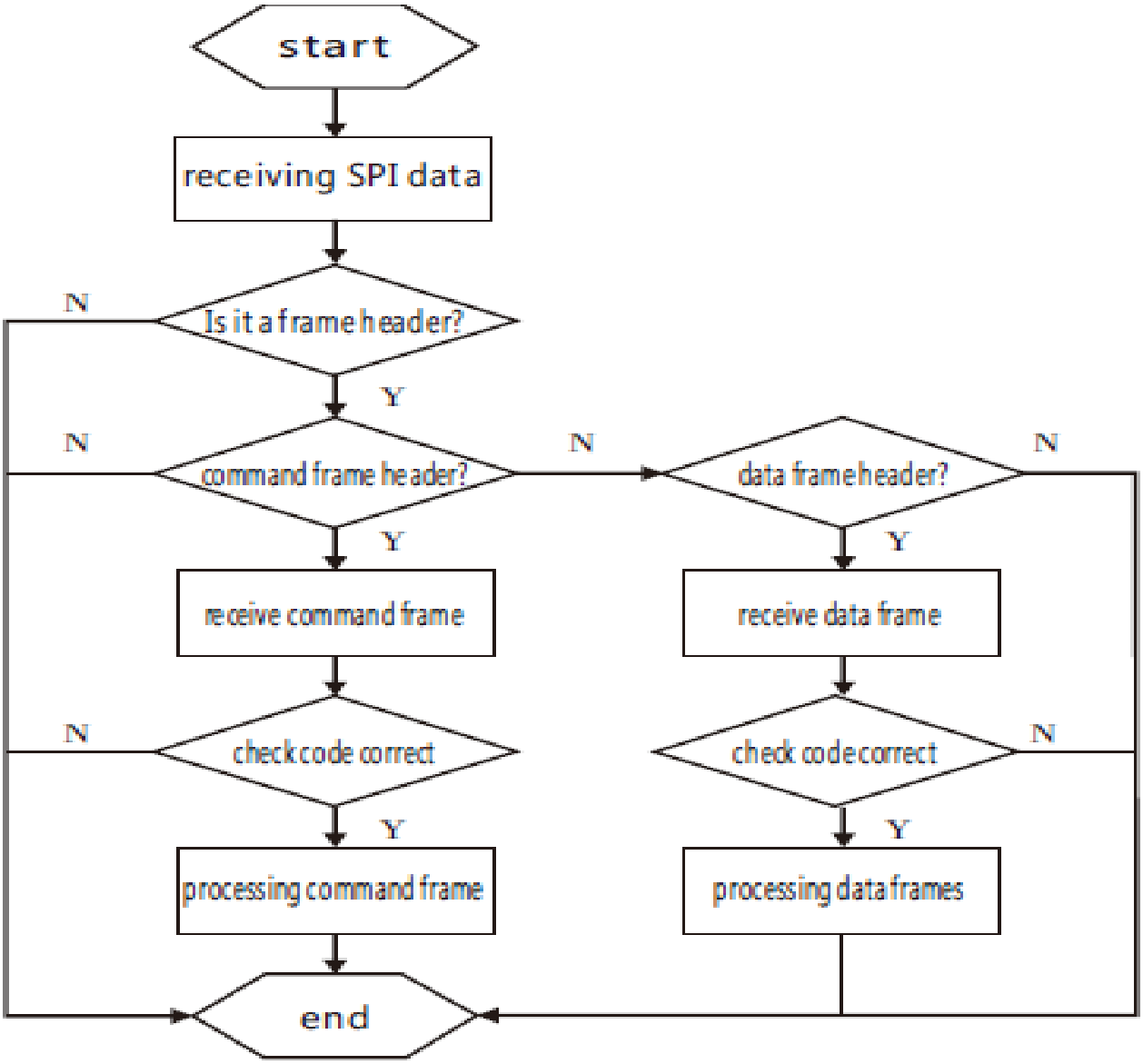

Figure 5. SPI program flow

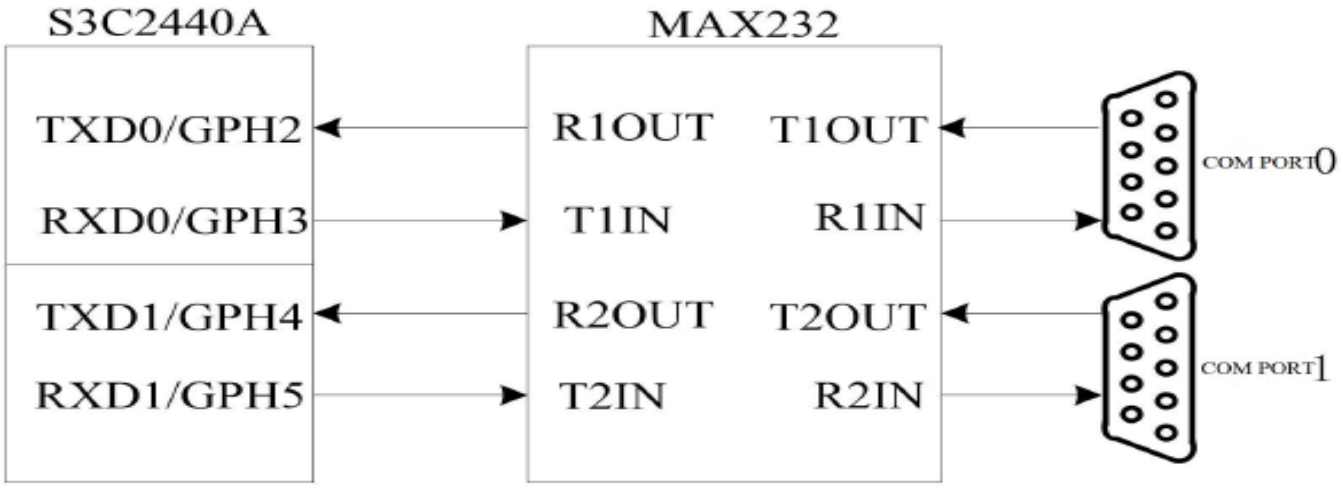

Figure 6. Local machine hardware connection

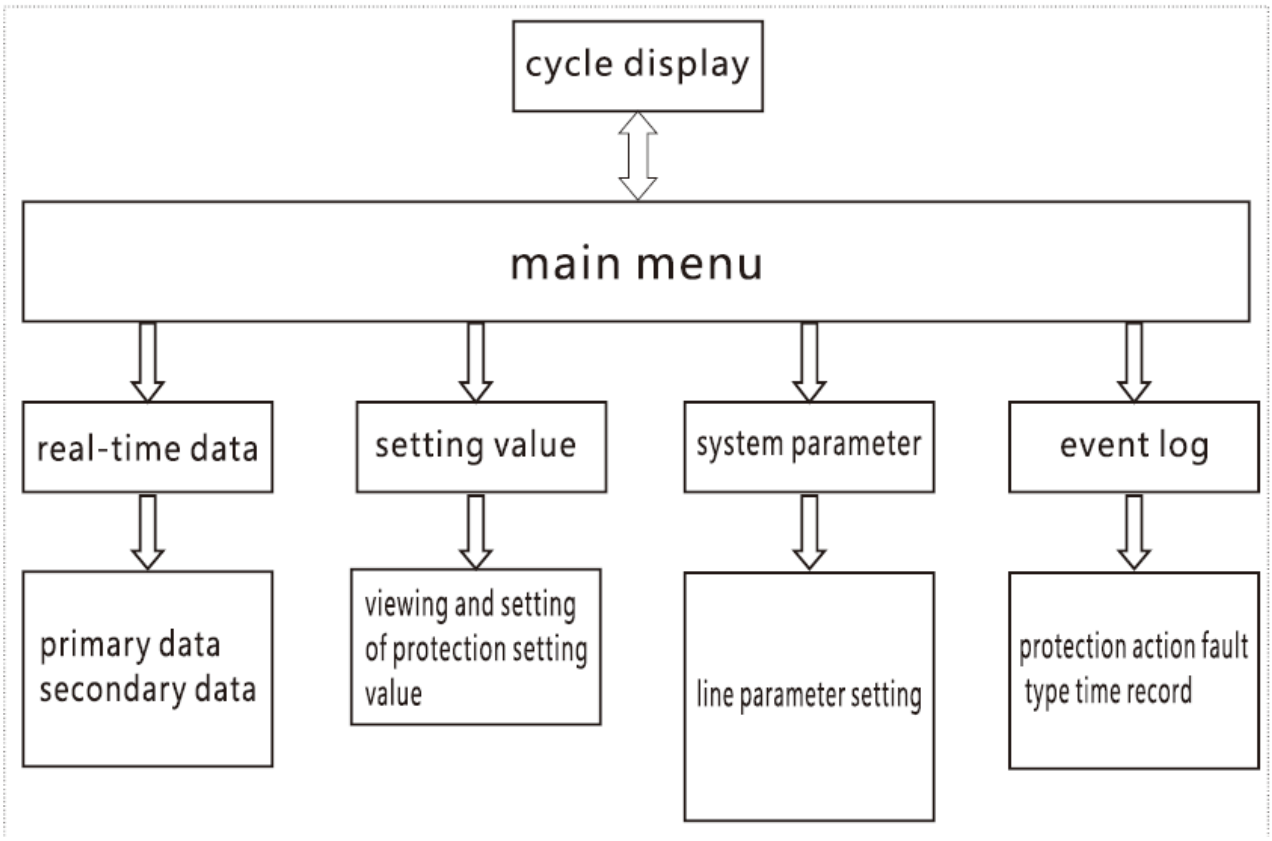

Figure 7. LCD software menu structure

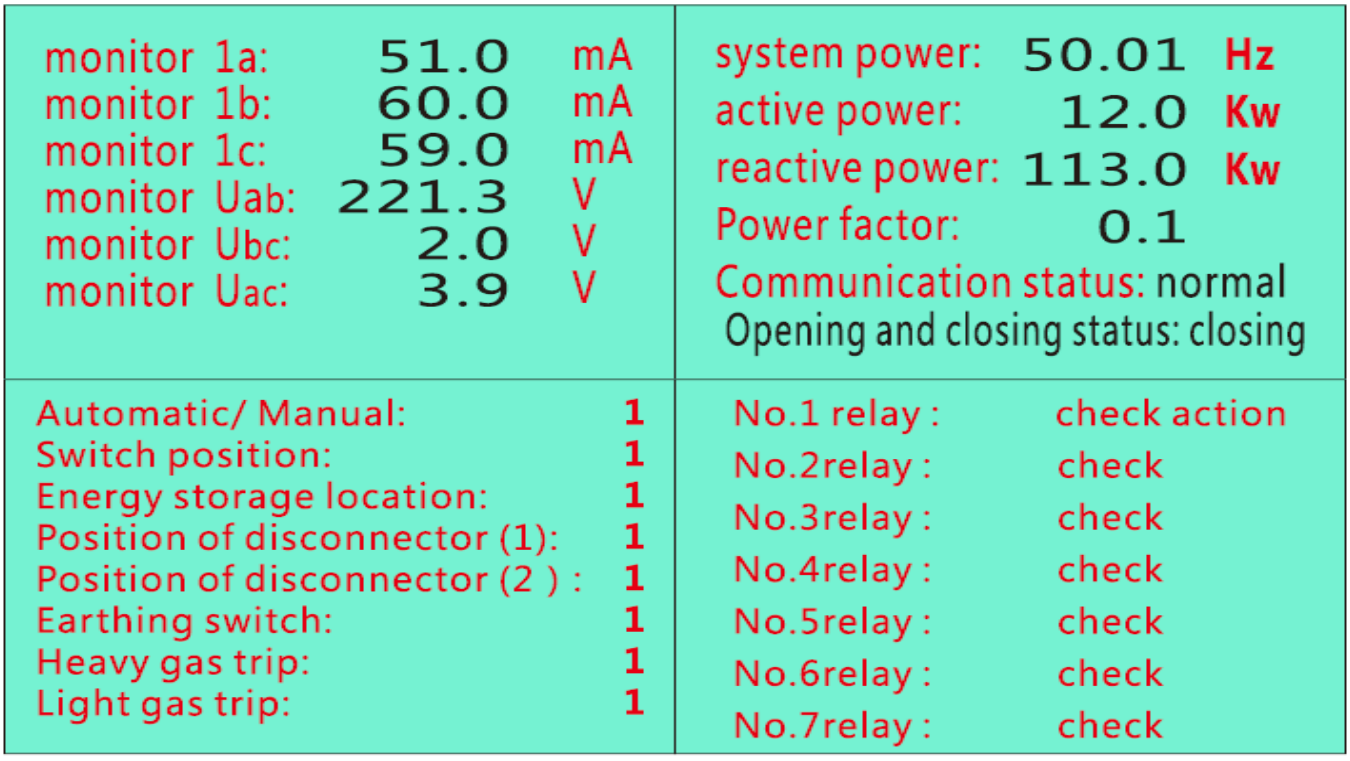

Figure 8. Real-time data display

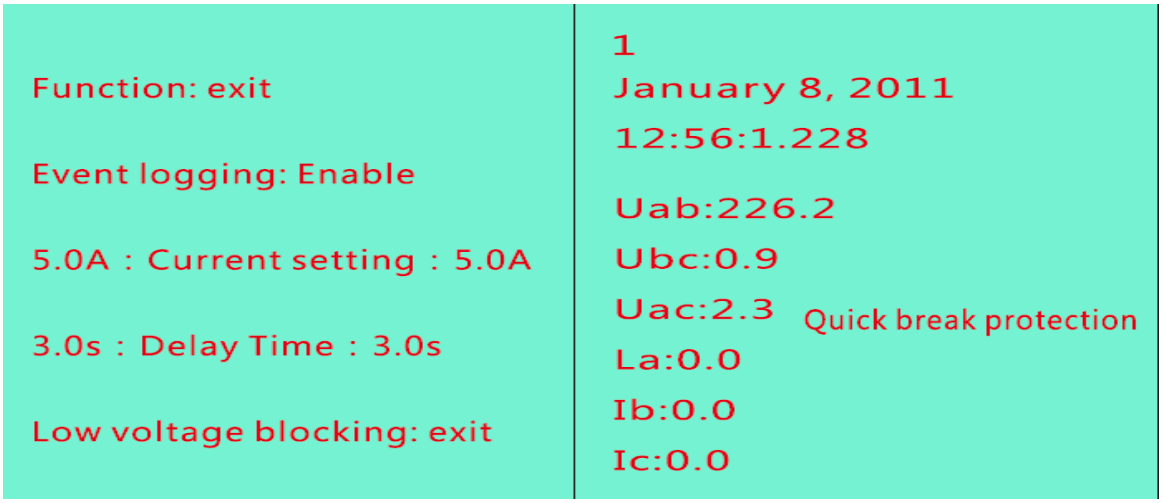

Figure 9. FTU value setting and event logging interface.

4 Test data and analysis

On the ZD43 relay protection test instrument platform, this article mainly tests analog measurement precision, logical reaction and tripping speed.

4.1 Analog measurement precision test

Voltage, current, frequency measurements are shown as table 1. Voltage absolute error of this FTU system is less than 1V. Current absolute error is less than 0.5A. The relative error is smaller than 2%. Because the FTU used the DSP capture unit to measure Frequency, it has obtained a higher precision, the absolute error is smaller than 0.05Hz, and the relative error is smaller than 0.1%. Furthermore, active/reactive power, power factor and other parameters are measured, and the experiment results show that the FTU will meet the appropriate requirements

.

Table 1. FTU measurement data

No.	Parameter Type	Standard Value	Measurements	Absolute Error	Relative Error (%)
1	Voltage	5V	4.92V	0.08V	1.6
2	Voltage	10V	10.14V	0.14V	1.4
3	Voltage	20V	19.90V	0.1V	0.5
4	Voltage	50V	49.81V	0.19V	0.38
5	Voltage	100V	100.86V	0.86V	0.86
6	Current	0.5A	0.51A	0.01A	2
7	Current	1A	1.01A	0.01A	1
8	Current	5A	4.96A	0.04A	0.8
9	Current	10A	9.92A	0.08A	0.8
10	Current	40A	39.62A	0.38A	0.95
11	Frequency	50Hz	49.98Hz	0.02Hz	0.04
12	Frequency	60Hz	60.03Hz	0.03Hz	0.05

4.2 Protection action response test

Relay protection, there is a quick-break protection, extension speed of trip protection, over-current protection, over voltage and low voltage protection and other protection logic. In the designing of FTU, the protection objective is that when external input signals comply with these conditions of protection logic, FTU can quickly drive on the remote control plug-in relays to trip or closing, so that external electrical equipment, such as circuit breakers, produce an appropriate opening actions in order to achieve the goal of fault isolation or line status adjustment.

Current protection test data can be seen in the above table, FTU action error between current value and setting value is less than 3%. It meets the requirement of less than 5% in relay protection action, and current instantaneous response time is less than 40ms which included the remote control panel relay inherent pull-in time.

Table 2. Current protection test data

No.	Quick determination value (A)	Responding Value (A)	Returned Value (A)	Relative Error (%)	Responding Time (ms)
1	5	5.05	4.95	1	37.473
2	5	5.10	4.95	2	32.565
3	10	10.10	10.00	1	37.824
4	10	10.10	9.90	1	31.971
5	20	20.40	20.00	2	30.468
6	20	20.20	19.80	1	32.579
7	50	50.00	49.00	0	35.127
8	50	50.50	49.50	1	31.853

5 Conclusion and Discussion

This article proposed dual-DSP SPI communication design in view of the FTU characteristics. It used the slot type structure in the overall design. By carrying on the test on the ZD43 (which is a model of electric motor driven relay protection test system) relay protection reflect scope reflector, it confirmed that the design is correct and it may be used in state grid[8].

Successful application of the FTU will make greater contributions to distribution network fault location and recovery. In the current distribution network fault diagnosis methods such as matrix algorithm and artificial intelligence algorithm, their preconditions are assumed that they got a large number of nodes information in the distribution, and then made the theoretical derivation and simulation calculations, and they largely didn't take into account the actual site status. If this FTU is used, the underlying data source of various distribution network's fault diagnosis algorithms may no longer came from the assumption sand simulation.

Disclosure statement

The author declares no conflict of interest.

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Analysis on Technical Transformation of Machining in Aviation Industry

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Abstract: This paper focuses on the analysis of the aviation industry machining technology transformation, and its current development status. The entire development plan for numerical control machine tool needs to be perfected, and the balance of numerical control technology development has to be strengthened. Additionally, the utilization rate of numerical control machines is relatively low; thus, raise the rate of equipment, numerical control, and numerical control equipment usage, and enhance the mechanical processing technology management task. Its aim is to improve aviation industry machining efficiency, which leads to a good development in China's aviation industry.

Keywords: Aviation industry; Mechanical processing; Technical improvement

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1 Introduction

In fact, the mechanical industry is important to China's social and economic development, and whether or not its processing technology is advanced and perfect has a significant impact on China's social and economic development. The aviation industry belongs to the main industry which shows the national strength of China. Its technological frontier is helpful to promote the further development of the aviation industry of China. In machining process, numerical control (NC) equipment belong to strong advanced processing equipment, because it has many advantages, which typically have high precision production, with strong production and sales, and has a lower production cost. As a result of the extensive utilization of aircraft manufacturers and their application in the aviation sector, the industry can not only improve its enterprise system. Due to certain of the mechanical parts used in the aviation sector have high quality and precision requirements, their processing must be completed by CNC machine tools, not only to increase the level of production management, but also to promote the overall development of companies.

2 Technical Development Status of Mechanical Processing in Aviation Industry

Since the establishment of the China's aviation industry, the mechanical processing technology, methods, and accuracy requirements have been very high, so in our country's aviation industry, as the first strong precision processing equipment and numerical control machine tool has been widely used, as the manufacturing of airborne equipment, engines, and fuselage structures. The utilization of advanced equipment to improve the aviation workpiece processing size progress, improve surface quality, improve production and sales, and many other aspects plays a vital role in the aviation sector.

To completely address the manufacturing needs of the aviation industry, China's aircraft machining department gradually incorporated developed-country 2D and 3D software into industrial production, greatly improving the aviation sector's machining efficiency. Furthermore, the introduction of 3D printers into the industry in recent years has provided a new processing method for aircraft machinery processing, which not only improves the machining

precision of mechanical parts but also increases their efficiency. However, due to China's late development of higher-precision equipment and instruments compared to developed countries, current research is unable to meet the long-term development needs of China's modern aviation machinery manufacturing industry, which has a negative impact on the industry's long-term development.

3 Aviation Industry Mechanical Processing Technical Problems

China's science and technology has advanced rapidly in recent years, and aviation industry machining technology has advanced significantly as well. However, an in-depth analysis of China's aviation industry machining technology development reveals that China's aviation industry machining technology still has some imperfections. If the balance of numerical control technology development needs to be strengthened, the overall development plan needs to be improved, and the numerical control rate of machine tools and the utilization rate of numerical control machine tools are both relatively low, the following details are needed:

3.1 The balance of numerical control technology development needs to be strengthened

After further analysis of the use of CNC machine tools in the aviation industry machining process revealed that the balance of CNC technology development in the use of CNC machine tools must be strengthened; the technology update speed of each host equipment is extremely fast, but the development of the use of other equipment on CNC machine tools is slow. The development of this imbalance has a significant impact on CNC machine tool dimensional accuracy. These factors are very unfavorable to the improvement of dimensional accuracy and surface quality in China's aviation industry equipment processing, restricting China's aviation industry equipment manufacturing industry's rapid development.

3.2 The overall development plan needs to be further improved

In terms of mechanical processing, the aviation industry in China must reform its technology based on certain airplane parts or the precision of some of the details. At the moment, the aviation industry's machining technology development is very adverse, and it is hindering the aviation industry's ability to improve the performance of machining parts. It significantly affects the goal of rapid development of China's aviation industry.

3.3 The numerical control rate of machine tools and the utilization rate of numerical control machine tools are relatively low

Due to the aviation industry's manufacturing and processing needs, dimensional accuracy and surface quality of parts are held to extremely high standards, requiring the utilization of high-quality equipment in aviation industry machinery manufacture in China, as well as highly qualified personnel. The mechanical processing department of China's aviation industry favors NC machine tools as significant components of mechanical processing equipment. However, based on further analysis and investigation of the aviation industry's development by the department of mechanical processing equipment, some mechanical processing departments in the aviation industry in our country have not yet reached the high-end CNC machine configuration, with domestic CNC machine accounting for nearly 40% of the total compared to developed countries. This is due to the fact that China's aviation sector, which has a strong mechanical processing department, has been slow to adopt new numerical control processing technology and equipment. Furthermore, it was stated that mechanical processing is not given too much attention and input in China's aviation industry, resulting in no circumstances to purchase front by the department of aviation industry machinery processing machinery and equipment.

After conducting a thorough study into the current state of China's aviation industry sector through the use of numerical control machine tool equipment, it was discovered that only around 60%

of the equipment utilized in the aviation industry is mechanical processing equipment. This is because the CNC machine center lacks advanced equipment operating personnel, or there is a major lack of programming, and programming technology cannot keep up with the development steps. The usage of machine tool centers cannot be totally replaced by artificial means, and CNC machine tool center parts processing will be severely hampered, restricting China's aviation sector equipment processing industry's sustainable development.

4 China's aviation industry machinery processing technical transformation content

The existing mechanical processing equipment in China's aviation industry's mechanical processing department is quite outdated, resulting in low equipment efficiency, which is particularly unfavorable to the long-term development of China's aviation industry mechanical processing sector. Only by thoroughly understanding the current technical issues in China's aviation industry's mechanical processing and proposing workable solutions will we be able to solve them. Only then will we be able to raise the mechanical processing level of our country's aviation industry.

4.1 Transformation Policy

For China's aviation industry, the technical problem in machining the staff in the aviation industry mechanical processing technology, to fully comply with the requirements for layout and planning, implement step by step, in the process of updating its technology should strictly comply with the current production quality requirements and processing precision requirements, specific technical renovation work. In the process of processing technology transformation, but also according to the production resources system planning CNC machine tools and other modern production equipment use efficiency, in order to assure dimensional accuracy and quality while improving the effectiveness of CNC machine tools.

4.2 Modification method

Through further analysis of China's aviation industry the human factor, namely management, should combine the aviation industry in the unique requirements of performance for some parts, processing technology of project of changing to formulate NC machine tools used in machining efficiency and technical reformation direction finding, now affect the machining quality and precision of the aviation industry in China. Then on the basis of innovating aviation industry machining technology, the processing quality of aviation products is further improved. At present, there are many technical transformation methods of machining in aviation industry in China, among which the more common ones are to rapidly improve the numerical control rate of equipment and the utilization rate of numerical control equipment, as well as to strengthen the technical management of machining. The details are as follows:

4.2.1 Rapidly improve the numerical control rate and the utilization rate of numerical control equipment

Nowadays, China's aviation industry machining department whether or not the use of numerical control equipment efficiency and allocative efficiency is low, the main factor that lead to this problem is the local computer development rate is lower than in developed countries. When programming becomes complex or the assigned employees must be fully replaced, mechanical processing cannot be achieved, CNC is used. To address this issue, many of China's aviation industry machining departments are rapidly introducing CNC processing equipment from developed countries, as well as high-level, high-quality CNC programming talents, to enable operators to better control CNC machine tools, improve work efficiency, and reduce personnel work pressure. In addition, on the basis of optimizing the numerical control equipment of the mechanical processing department of the aviation industry, the numerical control equipment's supervision level should also be improved in order to ensure the scientific nature and rationality of its use, as well as the effectiveness of its use, and to

ensure that the numerical control machine tool can further promote the aviation industry's mechanical processing efficiency.

4.2.2 Strengthen the management of machining technology

Processing technology and equipment together determine the precision and quality of products, so production staff must not only ensure the advanced nature of equipment, but also the accuracy of processing technology, which necessitates the department to improve processing technology management, which mainly includes the following points: First, consider the processing of the product early in the design phase, whether it is the workpiece structure or material to meet the processing needs of CNC machine tools, as well as the quality and precision of the workpiece must also consider the processing accuracy of the equipment; Second, to keep the processing technology of CNC equipment up to date, to provide regular training to CNC programmers and operators, to develop their CAD/CAM business skills, and to achieve free compilation of processing programs; Third, alternative measures should be utilized to ensure that the workpiece does not distort throughout the processing process.

5 Conclusion

To summarize, the development of the aviation industry plays an essential role in strengthening China's overall national strength, and the rapid expansion of the aircraft industry requires modern machining technology. Now, based on numerical control processing equipment analysis, China's aviation sector machining technology still has some issues, which is more typical of the need to strengthen the balance of numerical control technology development. Overall development planning has to be improved, and machine tool numerical control rate and numerical control machine tool utilization rates are relatively low. More research on these difficulties, to uncover the causes and formulate corresponding solutions, including increasing the utilization rate of equipment numerical control rate, is needed in China's aviation industry. Additionally, work on numerical control equipment management, strengthening mechanical processing technology, and full implementation of relevant personnel to achieve the specified goals. Thus, promoting the further development of China's aviation machinery manufacturing industry.

Disclosure statement

The author declares no conflict of interest.

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Book

Book with one to three authors

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Note: When referencing an entry from a dictionary or an encyclopedia with no author there is no requirement to include the source in the reference list. In these cases, only cite the title and year of the source in-text. For an authored dictionary/encyclopedia, treat the source as an authored book.

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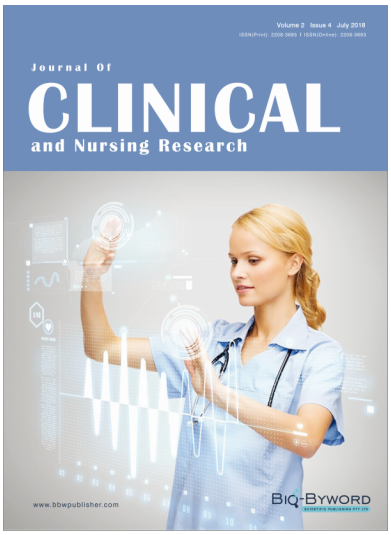

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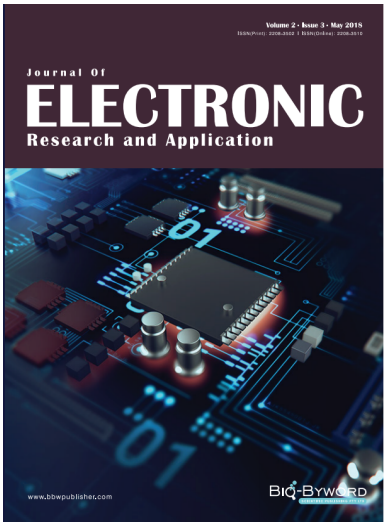

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